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Plot Planter for Small-Seeded Vegetables

ABSTRACT

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A commercial, hand-pushed planter was modified to plant small amounts of uncoated lettuce seed in test plots. It gave an average 37% acceptable spacing in rigid laboratory and field trials versus 32% for the planter used previously. Detailed specifications and drawings are included. With appropriately modified seed plates, the planter should be versatile enough for other small-seeded crops.

KEYWORDS: hand planting, lettuce, lettuce seed, planters, planting, seeders, seeding

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PLOT PLANTER FOR SMALL-SEEDED VEGETABLES

William J. Conley and William Waycott[1]

INTRODUCTION

Hand planting numerous small lots of uncoated lettuce seed in test plots is tedious work. Lettuce researchers surveyed used the following planters: John Deere 33, Planet Jr. No. 7309A, Earthway 1001B, Vibra Seeder, belt planter, cone planter, Planet Jr. Jiffy Seeder No. 22, modified Mini-Nibex, and modified Mini-Air. They reported that these planters all have serious deficiencies when used for plot work. The first four plant a high proportion of multiples, the next three give inconsistent results with small quantities of seed, and the last two are cumbersome to use.

For almost 30 years, the Planet Jr. Jiffy Seeder No. 22 has been the preferred plot planter for use in lettuce-breeding work at the U.S. Department of Agriculture, Agricultural Research Service, Salinas, Calif. research station, though it has been necessary to dilute the live seed with 50% dead seed to obtain more consistent stands. This planter is now obsolete, and parts are no longer available. So we needed to develop a small, lightweight, simple-to-use plot planter that could replace the Planet Jr. Jiffy Seeder No. 22.

DESIGN REQUIREMENTS

The plot planter had to be compact, lightweight, and maneuverable. It also had to be capable of planting small quantities of small vegetable seed such as a half gram or less of uncoated lettuce seed. The hopper had to be easy to fill and empty to minimize field-plot seeding time. A uniform seed-metering rate and precise depth control were both needed to minimize skips and multiples and to promote uniform emergence. In addition to these functional requirements, the design modifications had to be simple enough to be a practical alternative to existing planting methods.

DESIGN MODIFICATIONS

The Earthway Model 1001B Precision Garden Seeder manufactured by Earthway Products, Inc., is lightweight and convenient to use. Because of the design of the hopper, however, it needs several grams of seed and frequent agitation to facilitate seed pickup. Another disadvantage is a lack of a satisfactory seed plate for uncoated lettuce seed.

The key modification to the Garden Seeder was replacing the seed hopper with a machined aluminum cone-shaped hopper (figs. 1A, 2) with a funnel-shaped opening for easy filling. The rim of this hopper closely encompasses the vertically oriented seed plate, creating a 55° slope. The seeds continuously feed into the plate cells until the hopper is empty.

The seed plates were made from plastic blanks obtained from Earthway Products (figs. 1B, 2). Cells were sized to optimize seed spacing; skips greater than 12 inches were highly undesirable for stand establishment, and excessive multiples were undesirable from a thinning standpoint. The blank plate was milled down to 0.040-inch thickness in the cell area. The cell width is 0.0625 inch and the length, 0.200 inch. The cell notches at the periphery of the seed plate are angled 30° and have a 13° positive rake

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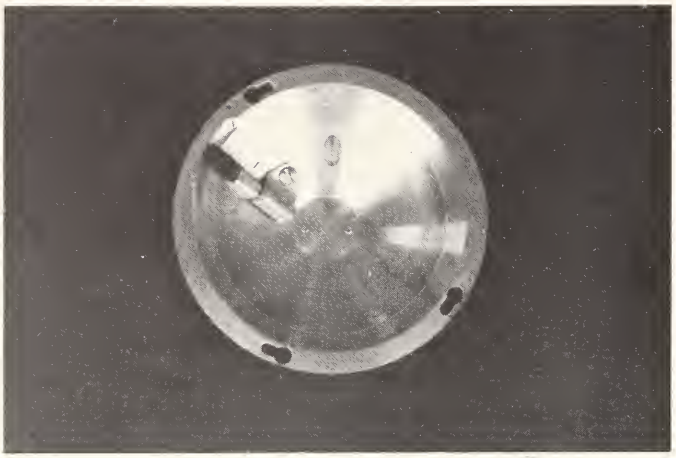

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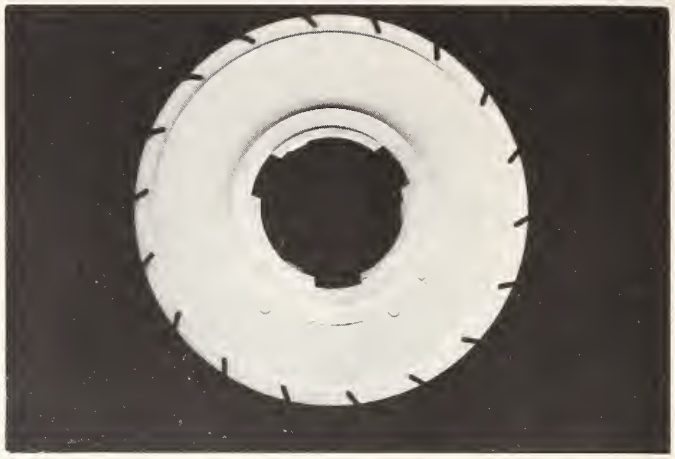

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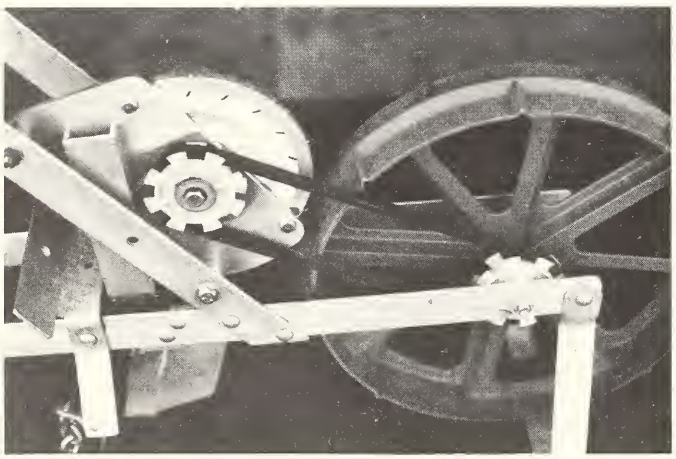

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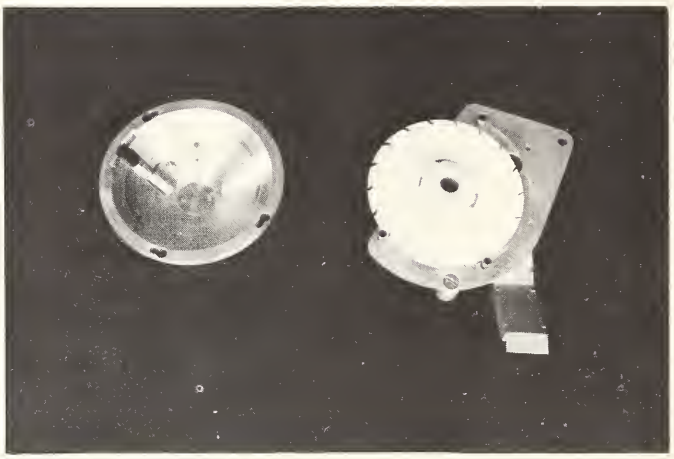

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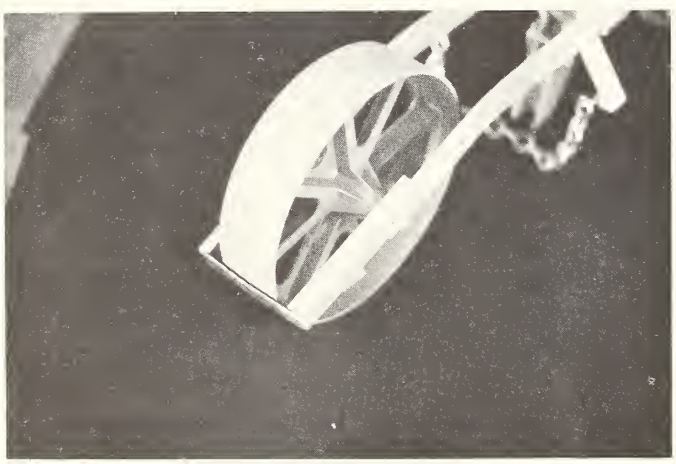

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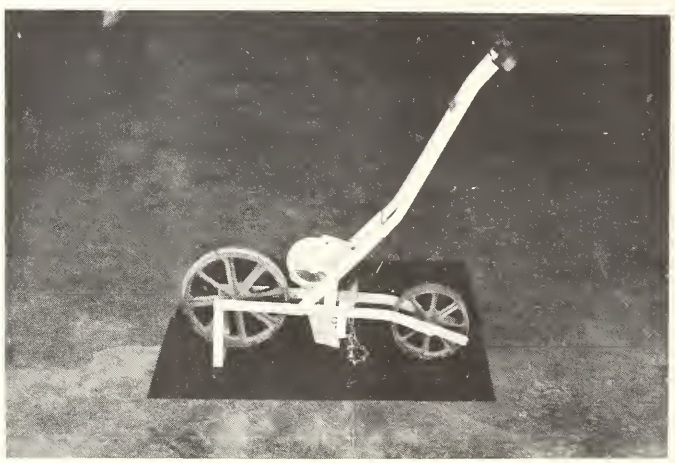

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Figure 1.--A, Seed hopper, inside view. Note brush positioned for trapped seed removal. B, Seed plate with cells for uncoated lettuce seed. C, Drive system showing drive wheel, belts, and sheaves. D, Redesigned backing plate with seed plate and chute installed and hopper removed. E, Scraper to minimize soil buildup in sticky soils. F, Overall view of modified Garden Seeder.

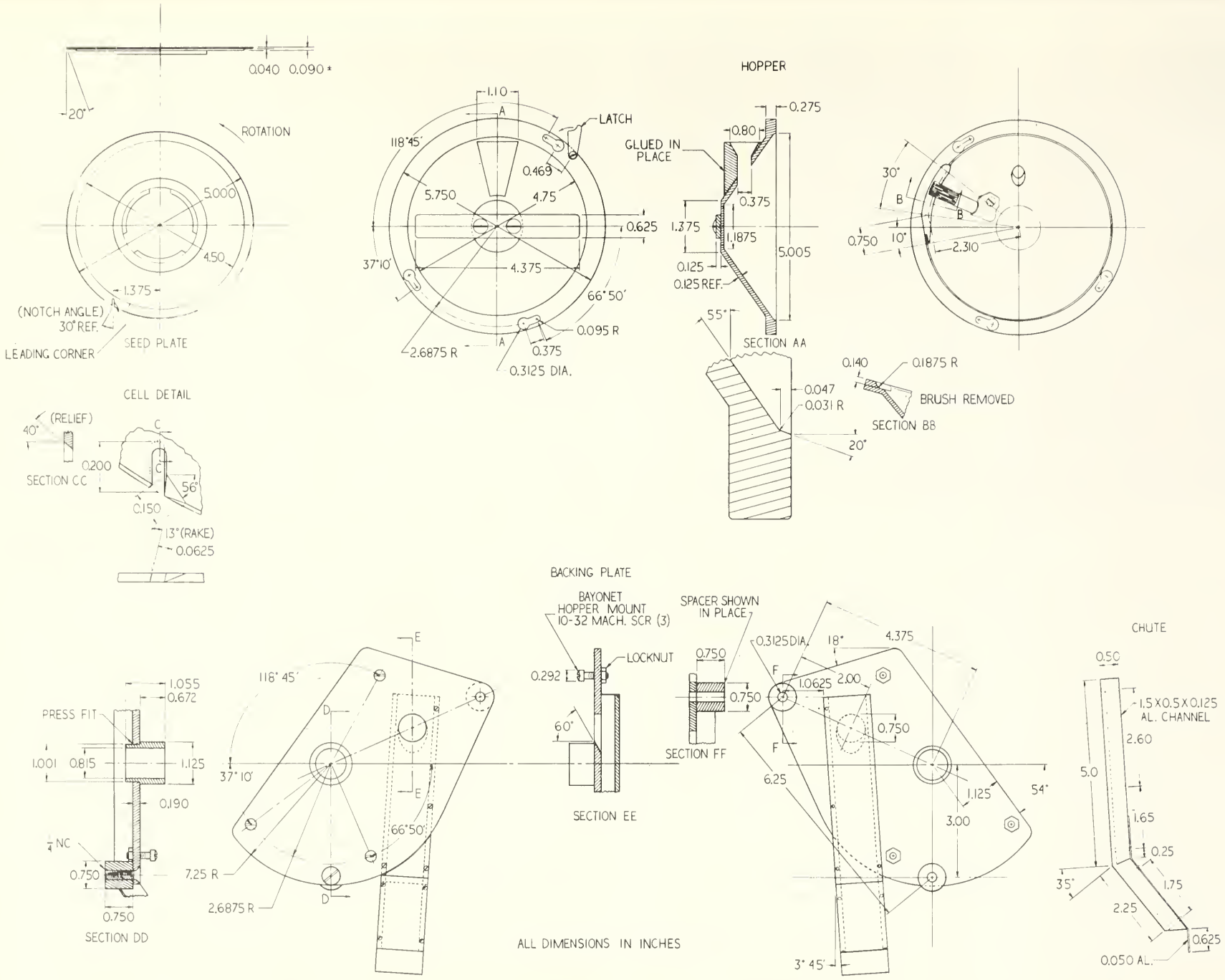

Figure 2.--Specifications of lettuce-seed plate, hopper, backing plate, and chute.

angle to prevent seeds from falling out as they are elevated. The leading corner of each cell was modified to promote more positive filling. A 40° relief angle at the inner end of the cell promotes delivery of seed into the seed chute at the drop point. A brush was positioned just past the drop point to insure removing trapped seed. Ideally, the 18 cells in the plate should plant seeds at a 2-inch spacing with the 36-inch circumference drive wheel and the standard one-to-one drive ratio (fig. 1C).

To accommodate the new hopper, a redesigned backing plate made from 0.190-inch aluminum plate was mounted in the same location as the original hopper (figs. 1D, 2). Three 10-32 fillister-head screws in the backing plate were mated with slots in the hopper, forming a bayonetlike mount to facilitate cleaning out the seed. The seed-plate hub and drive, retained from the original planter, were mounted in an aluminum bushing that was press-fit into the backing plate. A drop tube or chute fabricated from 1.5- by 0.5- by 0.125-inch aluminum channel was mounted on the rear of the backing plate with three 2-56 machine screws. The chute guides seed from the drop point in the backing plate to the furrow made by the original ground opener. A scraper (fig. 1E) was fitted to keep the packer wheel free from soil buildup in sticky soils. The modified planter unit (fig. 1F) measures 40 by 28 by 8 inches overall and weighs 11 pounds.

EXPERIMENTAL PROCEDURE

Replicated tests were conducted in the laboratory and in the field to evaluate the performance of the modified planter (table 1). Two speeds were used in the tests to determine whether they affected planting rate. In the laboratory, a wooden trough with cushioned tractive surfaces was used to simulate field conditions. In the field, several types of soil were chosen for performance comparisons. Tests were conducted in commercial lettuce fields that had received standard cultural practices. The locations of seeds in the laboratory and seedlings in the field were recorded and analyzed for percentage of acceptable spacings, percentage of multiple plantings, and percentage of skips.

The space between adjacent seeds or seedlings was defined as x. An acceptable spacing was defined as occurring when x fell within the range $0.5\bar{x} \leq x < 1.5\bar{x}$, where $\bar{x}$ is the mean spacing between all adjacent data points in the replication.[2] A multiple planting was defined as occurring when x was less than $0.5\bar{x}$, and a skip was defined as occurring when x was equal to or exceeded $1.5\bar{x}$.

RESULTS AND DISCUSSION

Table 1 shows the results of laboratory and field evaluations of the modified planter. It averaged 41.5% acceptable spacings in the lab and 32.5% in the field. Multiple plantings averaged 35.5% in the lab and 45.5% in the field, while skips averaged 23% in the lab and 22% in the field.

The criteria established for defining an acceptable spacing, a multiple planting, or a skip were rigid. Average spacing obtained with the modified planter ranged from 3.0 to 3.7 inches which exceeded the theoretical 2.0-inch spacing because of skips. Almost one in four spaces qualified as a skip. The desired final spacing in the field trials after thinning was 10 inches. If we had evaluated the anter based on the desired stand after thinning, the percentage of acceptable spacings would have been much higher. The analysis method used expressed the uniformity of planter performance rather than the results of the final plot stands.

Eight field-comparison trials showed average acceptable spacings of 37% for the modified planter versus 32% for the Planet Jr. Jiffy Seeder No. 22. Multiple plantings averaged 39% and 45% for the modified Garden Seeder and the Planet Jr. Jiffy Seeder, respectively, while skips

[2] Agnes, J. B. and H. J. Luth. 1957. Planter evaluation techniques. J. Agr. Eng. Res. 2:12.

averaged 24% and 22%. The stands attained with the modified planter in the field trials were adequate for the intended purpose. In addition, seed dilution was not required as it was with the Planet Jr. Jiffy Seeder No. 22. Speed of operation did not have any consistent effect on the results (table 1).

With alterations in the size, shape and number of seed-plate cells, the modified planter should be capable of handling most small-seeded crops.

Table 1.--Laboratory and field evaluations of the modified Garden Seeder[1]

Item	Laboratory		Field	
	1 mi/h	3 mi/h	1 mi/h	3 mi/h
	----------Percent----------			
Acceptable spacing	47	36	31	34
Multiple planting	32	39	47	44
Skips	21	25	22	22
Mean spacing in inches[2]	3.2	3.1	3.0	3.7

[1]Data are means of 3 replicated tests using uncoated lettuce seed. Field tests were sown in the Salinas Valley during July 1983 using the cultivar 'Salinas'.

[2]Not significant at 5%-LSD level.

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